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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN OR RELATING TO SECTION INSULATORS FOR USE IN OVERHEAD CONDUCTORS AND ELECTRICAL TRACTION SYSTEMS

(71) We, BRITISH INSULATED CALLENDER'S CONSTRUCTION COMPANY LIMITED, a British Company, of 7 Mayday Road, Thornton Heath, Surrey, do hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to insulating runners which are suitable for use as the whole or part of a section insulator in the overhead conductor of an electric traction system and to systems in which they are used. In a high-speed system, it is desirable for the mechanical properties (especially the mass per unit length, the displacement of the flexural neutral axis from the running surface, and the flexural modulus) to be as nearly as possible identical with those of the adjacent conductors.

A major advance in this direction was made by the introduction of the insulating runner in accordance with British Patent No. 983526, which can be inserted directly in the overhead contact wire and across which the pantograph or other current collector may run. In the form mainly used, that runner includes a rod of resin-bonded glass fibre with metallic end fittings compression jointed to it; to avoid "tracking" when exposed to atmospheric contamination the part of the rod between the end fittings is enclosed in a watertight covering built up of short tubular ceramic (or vitreous) bodies threaded on the rod and spaced from one another by resilient washers. The major part of each tubular body constitutes a portion of the effective running surface, but the ends of each tubular body are tapered to avoid presenting a sharp corner on which the current collector might strike.

It will be appreciated that this form of waterproof covering limits the flexibility of the runner and fixes its neutral axis substantially at its geometrical axis, and that its effectiveness depends upon the integrity of the seal formed between adjacent tubular bodies by the washers.

Synthetic resin compositions which have satisfactory resistance to tracking under some conditions, at least in A.C. systems, have now become available, and in the present invention such compositions are used to provide an improved insulating runner.

In accordance with the invention, an insulating runner comprises at least one elongate body of resin-bonded glass fibre (or other suitable fibre of high tensile strength), hereinafter referred to as the inner body, provided with metal end-fittings. A body of a resin composition that is resistant to tracking, hereinafter referred to as the outer body, at least partly encloses the inner body between the end-fittings and carries a plurality of inserts of ceramic or vitreous material constituting the effective running surface.

The inner body may be a circular rod or it may be flattened, e.g. to an oval or rectangular cross-section, in such a way that its transverse dimension generally parallel to the running surface is greater than its dimension perpendicular to the running surface to allow the neutral axis of the runner to be made closer to the running surface, as compared with the runner in accordance with British Patent No. 983526. Alternatively the single inner body may be replaced by two or more bodies extending parallel to one another. The bonding resin used need not have a high resistance to tracking unless substantial parts of the inner body are exposed.

The outer body is preferably made of one of the cycloaliphatic resin compositions that are specially formulated to give a high resistance to tracking. Suitable plasticisers may be included to obtain the desired degree of flexibility in the insulator.

When a single inner body in the form of a circular rod is used, the outer body may be of simple tubular form with a uniform wall thickness but especially when a flattened inner body or more than one inner body is used the

[Price 25p]

outer body is preferably flattened. The outer body should preferably completely enclose the inner body and be adherently bonded to the end-fittings so that no part of the inner body is exposed to atmospheric contamination. Preferably also the outer body should be adherently bonded to the inner body.

The ceramic or vitreous inserts are preferably confined to about one half of the circumference of the runner (the underside when used in the conventional orientation). Preferably the runner carries a single row of longitudinally aligned inserts. The external surface of the inserts will usually conform generally to the shape of the outer body; when an oval or other flattened shape is adopted, the mechanical and thermal stresses in the running face of the insulator are reduced. Adjacent inserts may be shaped so that they overlap in the longitudinal direction of the runner, and the ends of the inserts are preferably chamfered to avoid presenting a sharp edge to the current collector. Each insert is preferably mechanically interlocked with the body for example by providing dovetail or "sharks-tooth" projections on the embedded face thereof. High alumina ceramic, vitreous ceramic, or silicon nitride inserts are suitable.

The section insulator in accordance with the invention may consist entirely of the runner described, or the runner may be used in more complex section insulator assemblies, for example in the section insulator in accordance with British Patent No. 920289.

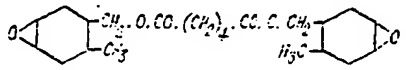
Ceramic inserts may be made by extrusion techniques or by moulding; to facilitate assembly a number of inserts, or possibly all of them, may be made integral with a connecting bar or web and handled in that form until they have been secured in the non-tracking resin body, preferably by casting the latter in situ, whereupon the bar or web may be ground away or otherwise removed.

Alternatively, however, the inserts may be individually positioned in the mould by securing them either to the mould wall or to the inner body. If the inserts are to be secured to the mould wall, some degree of mechanical interlock will normally be required, which may not always be acceptable since it precludes the provision of a smooth external surface of uniform cross-section and it is therefore preferable to secure the individual ceramic inserts to the inner body, for example using spots of a suitable adhesive, preferably a thermosetting adhesive. Another possibility with some shapes of insert is to space the inserts by means of preformed washers or other spacers of a suitable resin, such spacers being shaped to allow the required flow of resin during casting. It has been found that the preferred type of resin composition for the outer body can also be used for such spacers, provided that the surfaces of the spacers are abraded to obtain a surface to which the subsequently cast resin will sufficiently adhere.

An example of a suitable vacuum casting resin composition for the outer body comprises, in part by weight:

Cycloaliphalic epoxy resin ERL—4289	100
Hexahydrophthalic anhydride (hardener)	35
Stannous octoate (accelerator)	0.5
Silica Fleur (filler)	100

The resin ERL—4289 is sold by Union Carbide Corporation and by Bakelite Limited, and has the formula



The silica flour preferably has a maximum particle size not greater than 80 micrometers and preferably includes a high proportion of much smaller particles.

The invention will be further described, by way of example, with reference to the accompanying drawings wherein:

Figure 1 is a transverse cross-section of a first example of an insulating runner in accordance with the invention;

Figure 2 is a longitudinal vertical cross-section of the runner shown in figure 1;

Figure 3 is a view of the underside of the same runner; and

Figure 4 is a transverse cross-section of a second example of an insulating runner in accordance with the invention.

The runners shown are suitable for use in a 25kV system such as that of British Rail. The runner shown in figures 1—3 comprises a circular resin-bonded glass fibre rod 1 of 6.5 mm diameter and about 1250 mm long with suitable end-fittings 2 secured to it by compression jointing or by an adhesive. The part of the rod between the end-fittings is centrally embedded in a cylindrical outer body cast from the non-tracking cycloaliphatic resin composition described above. The outer-body has an external diameter of 15 mm. The cast resin body adheres to the end fittings and has embedded in it to form the major part of its underside a longitudinal row of inserts 4 in the form of ceramic shells, each semi-circular in section with an external diameter substantially equal to that of the resin body and a general thickness of 2.5 mm. The ceramic shells are keyed to the cast resin body by internal sharkstooth projections 5. The end faces of the shells are inclined at an angle of 45° to the axis of the insulator, measured as projected onto a horizontal plane, so that the shells overlap longitudinally. The length of the longitudinal side of each shell is about 12 mm and the spacing between adjacent shells about 1.6 mm. The extreme

ends 6 of the shells are chamfered to avoid presenting a sharp edge on which the current collector might strike.

Figure 4 shows an alternative cross-section for the insulating runner, and also shows the sharkstooth projections replaced by dovetail projections 7.

WHAT WE CLAIM IS:—

1. An insulating runner comprising at least one elongate inner body of resin-bonded glass fibre or other suitable fibre of high tensile strength, metal end-fittings on the said inner body, and an outer body of a resin composition that is resistant to tracking at least partly enclosing the said inner body between the said end-fittings and carrying a plurality of inserts of ceramic or vitreous material constituting the effective running surface.

2. An insulating runner comprising at least one elongate inner body of resin-bonded glass fibre or other suitable fibre of high tensile strength, metal end-fittings on the said inner body, and an outer body of a resin composition that is resistant to tracking completely enclosing the said inner body between and adhering to the said end-fittings and carrying a plurality of inserts of ceramic or vitreous material constituting the effective running surface.

3. An insulating runner comprising at least one elongate inner body of resin-bonded glass fibre or other suitable fibre of high tensile strength, metal end-fittings on the said inner body, and an outer body of a resin composition that is resistant to tracking at least partly enclosing the said inner body between the said end-fittings and carrying a plurality of inserts of ceramic or vitreous material confined substantially to one half of the circumference of the runner and constituting its effective running surface.

4. An insulating runner comprising at least one elongate inner body of resin-bonded glass fibre or other suitable fibre of high tensile strength, metal end-fittings on the said inner body, and an outer body of a resin composition that is resistant to tracking at least partly enclosing the said inner body between the said end fittings and carrying a plurality of inserts of ceramic or vitreous material constituting the effective running surface, each of the said inserts being mechanically interlocked with the said outer body.

5. An insulating runner as claimed in any one of the preceding Claims in which the said inner body is a rod of circular cross-section.

6. An insulating runner as claimed in Claim 5 in which the said outer body is of simple tubular form with a uniform wall thickness.

7. An insulating runner as claimed in any one of Claims 1—4 in which the said inner body has a transverse dimension generally parallel to the running surface that is greater than its dimension perpendicular to the running surface.

8. An insulating runner as claimed in any one of Claims 1—4 in which there at least two inner bodies extending parallel to one another.

9. An insulating runner as claimed in any one of claims 1—5 or claim 7 or claim 8 in which the said outer body has a transverse dimension generally parallel to the running surface that is greater than its dimension perpendicular to the running surface.

10. An insulating runner as claimed in any one of the preceding claims in which the said outer body is formed of a cycloaliphatic resin composition that is resistant to tracking.

11. An insulating runner as claimed in Claim 9 in which the said resin composition is constituted substantially as hereinbefore described by way of example.

12. An insulating runner as claimed in any one of the preceding claims in which the said inserts are longitudinally aligned in a single row.

13. An insulating runner substantially as hereinbefore described with reference to and as shown in figures 1—3 of the accompanying drawings.

14. An insulating runner substantially as hereinbefore described with reference to the accompanying drawings and as shown in figure 4 thereof.

15. An electric traction system including as part or all of a section insulator in an overhead conductor thereof an insulating runner as claimed in any one of the preceding claims.

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1326071 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.3.

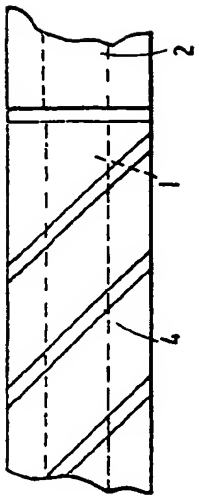

FIG.2.

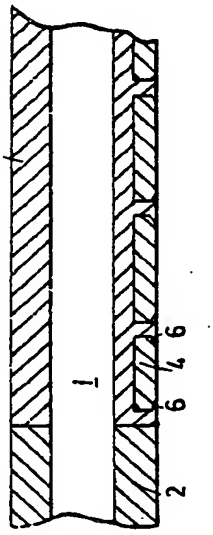

FIG.4.

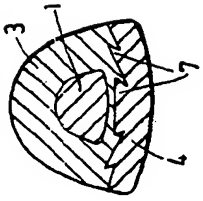

FIG.1.